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Primordial black hole superradiance and evaporation in the string axiverse

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In the string axiverse scenario, light primordial black holes may spin up due to the Hawking emission of a large number of light (sub-MeV) axions. We show that this may trigger superradiant instabilities associated with a heavier axion during the black holes' evolution, and study the coupled dynamics of superradiance and evaporation. We find, in particular, that the present black hole mass-spin distribution should follow the superradiance threshold condition for black hole masses below the value at which the superradiant cloud forms, for a given heavy axion mass. Furthermore, we show that the decay of the heavy axions within the superradiant cloud into photon pairs may lead to a distinctive line in the black hole's emission spectrum, superimposed on its electromagnetic Hawking emission.

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